We claim:

1. A method for use in a system adapted to transmit at least four series of transmit sequences over at least four transmit antennas, the method comprising the step of:

space-time coding at least two pairs of symbol sub-streams, each of the pairs of symbol streams being space-time coded to form a respective pair of the transmit-sequence chains, the space-time coding being such that at least one of the formed pairs of the transmit-sequence chains is a function of symbols of the respective pair of symbol sub-streams and not a function of the symbols of the other pairs of the symbol sub-streams.

2. The invention of claim 1, wherein

each transmit sequence has a duration of four symbol periods;

each transmit sequence of a particular transmit-sequence chains is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol-sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol-sub-stream pair; and

portions of the at least four transmit-sequence chains are representable by a matrix where:

each row of the matrix represents one transmit sequence of a respective different one of the transmit-sequence chains, and

each column of the matrix represents one symbol period.

3. The invention of claim 2, wherein the matrix is orthogonal.

4. The invention of claim 1, wherein portions of the at least four transmit-sequence chains are representable by a matrix where:

each row of the matrix represents one transmit sequence of a respective different one of the transmit-sequence chains;

each column of the matrix represents one symbol period; and

the matrix is $\begin{bmatrix} b_1 & b_1 & -b_2^* & -b_2^* \\ b_2 & b_2 & b_1^* & b_1^* \\ b_3 & -b_3 & -b_4^* & b_4^* \\ b_4 & -b_4 & b_3^* & -b_3^* \end{bmatrix}$,

where:

b_1 and b_2 are symbols of first and second symbol sub-streams, respectively, of one of the symbol-sub-stream pairs,

b_3 and b_4 are symbols of first and second symbol sub-streams, respectively, of another of the symbol-sub-stream pairs, and

b_1^*, b_2^*, b_3^*, and b_4^* are complex conjugates of b_1, b_2, b_3, and b_4, respectively.

5. The invention of claim 1, wherein portions of the at least four transmit-sequence chains are representable by a matrix where:

each row of the matrix represents one transmit sequence of a respective different one of the transmit-sequence chains;

each column of the matrix represents one symbol period; and

the matrix is $\begin{bmatrix} b_1 & -b_2^* & 0 & 0 \\ b_2 & b_1^* & 0 & 0 \\ 0 & 0 & b_3 & -b_4^* \\ 0 & 0 & b_4 & b_3^* \end{bmatrix}$,

where:

b_1 and b_2 are symbols of first and second symbol sub-streams, respectively, of one of the symbol-sub-stream pairs,

b_3 and b_4 are symbols of first and second symbol sub-streams, respectively, of another of the symbol-sub-stream pairs, and

b_1^*, b_2^*, b_3^*, and b_4^* are complex conjugates of b_1, b_2, b_3, and b_4, respectively.

6. The invention of claim 1, wherein the space-time coding step comprises the steps of:

space-time coding a first pair of symbol sub-streams to form a first pair of transmit-sequence chains, the first pair of transmit-sequence chains being a function of the symbols of the first symbol-sub-stream pair and not a function of the symbols of a second symbol-sub-stream pair; and

space-time coding the second pair of symbol sub-streams to form a second of transmit-sequence chains, the second pair of transmit-sequence chains being a function of the symbols of the second symbol-sub-stream pair and not a function of the symbols of the first symbol-sub-stream pair.

7. The invention of claim 1, further comprising the step of transmitting the at least four transmit-sequence chains on a respective one of the transmit antennas.

8. The invention of claim 1, further comprising the step of spreading at least a plurality of symbols of the transmit-sequence chains using a spreading code.

9. The invention of claim 1, further comprising the steps of:

channel coding each of at least four data sub-streams using a channel code; and

mapping each of the channel-coded primitive data stream into symbol-space to produce a respective one of the symbol sub-streams.

10. A transmitter adapted to transmit at least four symbol sub-streams, the transmitter comprising:

a space-time encoder adapted to space-time code at least two pairs of symbol sub-streams, each of the pairs of symbol streams being space-time coded to form a respective pair of the transmit-sequence chains, the space-time coding being such that at least one of the formed pairs of the transmit-sequence chains is a function of symbols of the respective pair of symbol sub-streams and not a function of the symbols of the other pairs of the symbol sub-streams; and

at least four transmit antennas, each having an input for receiving at least one of the at least four transmit-sequence chains, the input coupled to an output of the space-time encoder.

11. The invention of claim 10, wherein

each transmit sequence has a duration of four symbol periods;

each transmit sequence of a particular transmit-sequence chains is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol-sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol-sub-stream pair; and

portions of the at least four transmit-sequence chains are representable by a matrix where:

each row of the matrix represents one transmit sequence of a respective different one of the transmit-sequence chains, and

each column of the matrix represents one symbol period.

12. The invention of claim 11, wherein the matrix is orthogonal.

13. The invention of claim 10, wherein portions of the at least four transmit-sequence chains are representable by a matrix where:

each row of the matrix represents one transmit sequence of a respective different one of the transmit-sequence chains;

each column of the matrix represents one symbol period; and

the matrix is one of the matrices of the set of matrices consisting of:

$$\begin{bmatrix} b_1 & b_1 & -b_2^* & -b_2^* \\ b_2 & b_2 & b_1^* & b_1^* \\ b_3 & -b_3 & -b_4^* & b_4^* \\ b_4 & -b_4 & b_3^* & -b_3^* \end{bmatrix} \text{ and } \begin{bmatrix} b_1 & -b_2^* & 0 & 0 \\ b_2 & b_1^* & 0 & 0 \\ 0 & 0 & b_3 & -b_4^* \\ 0 & 0 & b_4 & b_3^* \end{bmatrix},$$

where:

b_1 and b_2 are symbols of first and second symbol sub-streams, respectively, of one of the symbol-sub-stream pairs,

b_3 and b_4 are symbols of first and second symbol sub-streams, respectively, of another of the symbol-sub-stream pairs, and

b_1^*, b_2^*, b_3^*, and b_4^* are complex conjugates of b_1, b_2, b_3, and b_4, respectively.

14. The invention of claim 10, wherein the space-time encoder is adapted to spread at least a plurality of symbols of the transmit-sequence chains using a spreading code.

15. The invention of claim 10, wherein the transmitter further comprises:

an input; and

at least one channel encoder being interposed between the input and the space-time encoder, the channel encoder adapted being to channel code a data sub-stream using a channel code.

16. The invention of claim 15, wherein the transmitter further comprises at least one mapper, the mapper being interposed between the channel encoder and the space-time encoder, the mapper being adapted to map the channel coded data sub-stream into symbol-space to produce a respective one of the symbol sub-streams.

17. A base station of a wireless communication system, the base station comprising the transmitter of claim 10.

18. A mobile terminal comprising the transmitter of claim 10.

19. The invention of claim 10, further comprising a plurality of radio frequency units, each having an input coupled to a respective output of the space-time encoder, each radio frequency unit adapted to convert a respective transmit sequence series from baseband to a radio frequency modulated signal.

20. A receiver comprising:

at least one receive antenna; and

a matrix multiplier for multiplying a matrix with received symbol sub-streams of a signal received by the receive antenna, the matrix having at least two pairs of consecutive rows, each such pair being a function of channel characteristics of at least two channels that terminate on the receive antenna but not of channel characteristics of other channels that terminate on the receive antenna, and the matrix being orthogonal.

21. The invention of claim 20, wherein the matrix is $\mathbf{H}^{\dagger}$, which comprises one of the matrices of the set of matrices consisting of:

$$\begin{bmatrix} h_1^* & h_2^* & h_2 & h_2 \\ h_2^* & h_2^* & -h_1^* & -h_1 \\ h_3^* & -h_3^* & h_4 & -h_4 \\ h_4^* & -h_4^* & -h_3 & h_3 \end{bmatrix} \text{ and } \begin{bmatrix} h_1^* & h_2 & 0 & 0 \\ -h_2^* & h_1 & 0 & 0 \\ 0 & 0 & h_3^* & h_4 \\ 0 & 0 & -h_4^* & h_3 \end{bmatrix},$$

where h_1, h_2, h_3, and h_4 are the complex channel characteristics of the channels between a 1st, 2nd, 3rd, and 4th channel encoder, respectively and the receive antenna.

22. The invention of claim 21, wherein the channels are flat-faded channels.